USMC Industry Day #2

Software Reprogrammable Payload (SRP)
System Development Overview
## 5 May 2009

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How to Rapidly Respond to User Requirements

- **Long development and procurement timelines in major acquisition programs**
- **The world changes a lot in a decade between when the requirements are written and programs are executed**
- **We think that the solution is a layered approach**
  - **Provide a framework to support current and future hardware and software**
  - **Build an acquisition strategy that supports continuous development to be rapidly pushed to users when needed and incrementally otherwise**
- **Government scientists and engineers working with DoD users to ensure developed standards and requirements will have applicability beyond the short term**
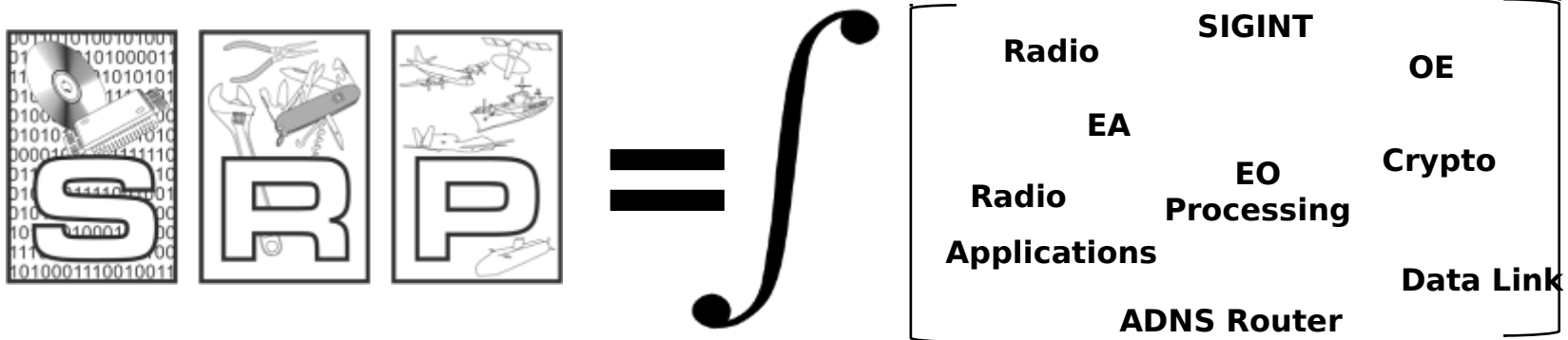
USMC Needs, Requirements and Ideas   **Government Labs and Industry**
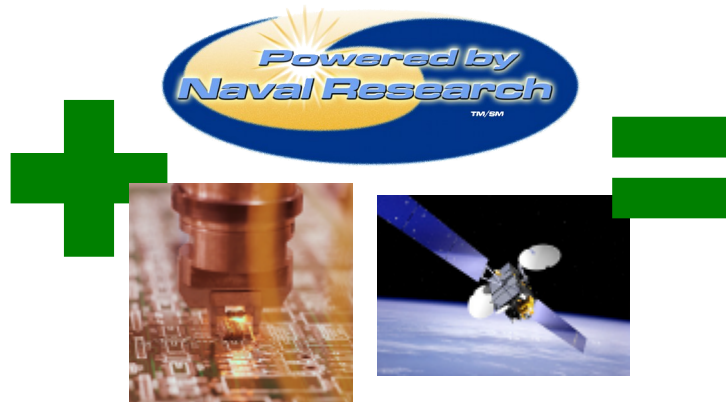

Mission Success

- **Software Reconfigurable Payload**
  - **NOT** *just* **a radio**
  - **NOT** *just* **a receiver/SIGNT payload**
  - **NOT** *just* **a processor**
  - **NOT** *just* **a payload software infrastructure framework**
  - **NOT** *just* **a cryptographic module**
  - **NOT** *just* **a data or format converter**
  - **NOT** *just* **a waveform application**

$$\text{SRP} = \int \left[\begin{array}{c} \text{Radio} \quad \text{SIGINT} \quad \text{OE} \\ \text{EA} \\ \text{Radio} \quad \text{EO Processing} \quad \text{Crypto} \\ \text{Applications} \\ \text{ADNS Router} \quad \text{Data Link} \end{array} \right]$$

SRP is the result of Integrating A Set of Capabilities Which May Include all or a subset: Comms functions, SIGINT, Crypto, Data Routing, and others not yet conceived of yet

SRP Development Philosophy

- **Government-Industry Team**
  - **Involved, committed project sponsors: USMC HQ Aviation, ONR, NAVAIR, OSD RRTO, Navy N6F**
  - **NRL As Technical Lead**
  - **A contractor team supplying engineering expertise; not a product**
- **Government owned design and software**
  - **Government purpose rights at the minimum, open source/GPL whenever appropriate**
- **Portable software design**
  - **As much industry standard code as possible**
  - **Minimize specialized software and hardware**
- **Modular at all levels**
  - **Hardware components**
  - **Software components**
  - **Firmware/processing components**
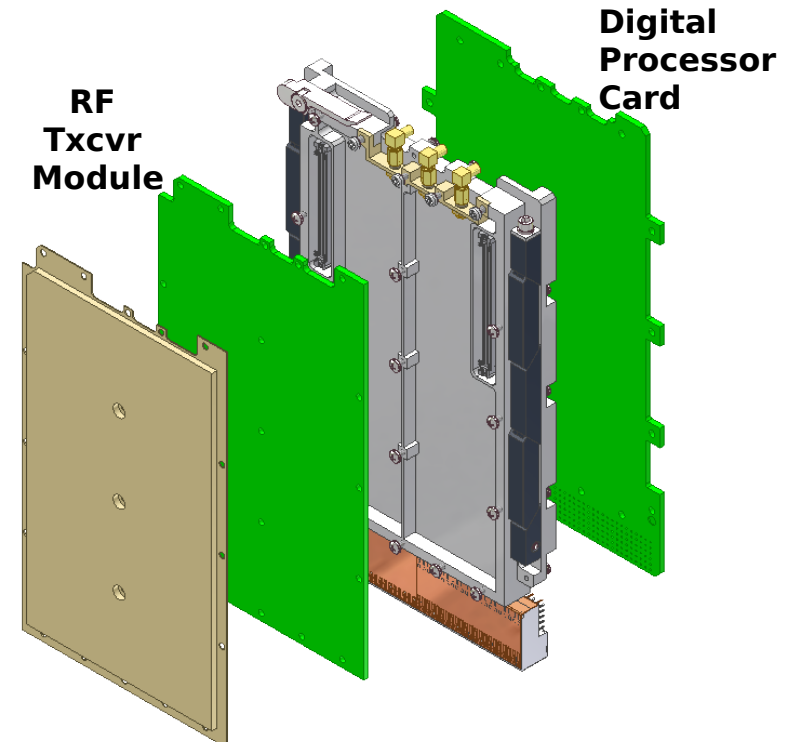
Digital Processor Card

RF Txcvr Module

- **Software Reconfigurable Payload technologies hold great promise for allowing diverse use of applications**

- **Keep "proprietary" technology out of SRP applications**
  - **Consider carefully the lifecycle costs of buying into proprietary waveforms and other items vice government development and ownership**

- **Leverage open source (or government source) as much as possible**
  - **Use development tools/toolchains that are "lowest common denominator"**
  - **Manage classification of code and modules carefully**
  - **Share/post source code to be used by others and/or enhanced by others**

open source ™

- **Utilize collaboration methodologies – "software forge.mil" being one example in government use – which itself is based on the "Sourceforge" open-source model**

- **Government being intimately involved – controllers of the ICDs, and owners of the software products**

- **GFE Software Development Kits and/or Software Development Stations**

  - **Level the playing field so SRP application development does not require a million dollar investment in infrastructure**

  - **Provide access to actual "deployable" hardware suites and test signal generators**

- **Development Team Diversity**
  - **SRP related strengths**
  - **Vested interests and expertise**
    - **Avoid the "winner-take-all" approach, or at least encourage large primes to diversify their team with subject-matter expert experts**
    - **Enabled diversified business models for application development**
- **Government commitment helps to encourage success**
  - **Adequately fund the project**
  - **Commit to building up infrastructure/ICDs, and other sharing mechanisms**
 - **Support conferences and other ways to share information**

Large Aerospace Company

University

Small Business

Provide Innovation Opportunities to Application Developers

- **SRP system provides multiple means for application developers to implement their area of their expertise**

- **Porting is straightforward**
  - **PowerPC compiler is open source (GNU)**
  - **FPGA development**
    - **MATLAB code**
    - **FPGA router tool**
    - **SRP "HAL" isolates FPGA interfaces from FPGA signal processing elements**
  - **Operating System**
    - **Linux for as long as possible for as many components as possible**
    - **Move to limited use of a proprietary OS if required due to security certification requirement**
    - **In either case, maintain POSIX compatibility**
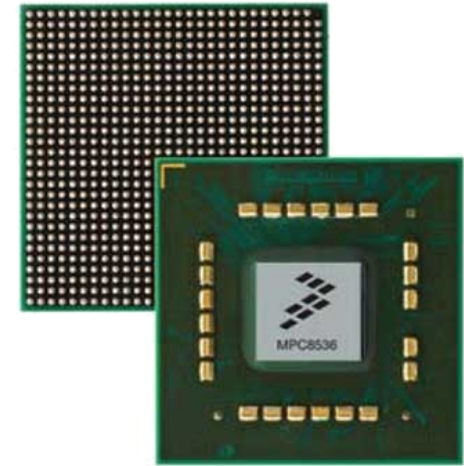
Development Environment

- **Developers will be supplied government owned software development kit (SDK)**

- **SDK provide a software development environment at multiple levels of fidelity**
  - **Standalone [80%]**
    - **Use a laptop or PC to develop software**
    - **Completely build and simulate on the laptop**
  - **Developers kit / SRP Processor board [90%]**
    - **PowerPC Target**
    - **FPGA resources on SRP Processor board**
  - **SRP Transceiver card [100%]**
    - **PowerPC target**
    - **FPGA resources**
    - **RF resources**
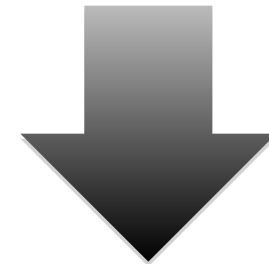
Summary

- Long acquisition timelines are a fact of life
- Building non-proprietary, government owned software and hardware designs allows a framework for enabling new disruptive acquisition models for new capability
- This requires the government to increase their involvement and go beyond being an acquisition agent but an agent of the program's success
- Tightly Coupled Government and Industry Team is Essential for Success

USMC / NRL Software Reprogrammable Payload (SRP) Program Enables Rapid Response to Changing Needs While Ensuring Affordability – by Solving the Problem Once

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